

**REMARKS**

Claims 1-6 stand rejected under 35 U.S.C. 102 as being anticipated by Chen et al. '529 ("Chen"), and claims 7-10 stand rejected under 35 U.S.C. 103 as being unpatentable over Chen. Claims 1 and 5 are independent. These rejections are respectfully traversed for the following reasons.

**A. Claim 1**

Claim 1 recites in pertinent part, "forming, by performing oxygen plasma treatment, a *passive* antioxidant layer on the part of the surface of the conductive pattern exposed while removing the resist pattern" (emphasis added). One of the features of the present invention as recited in claim 1 resides in forming a *passive* antioxidant layer on the part of the surface of the exposed conductive pattern while removing the resist pattern by performing oxygen plasma treatment. According to the present invention, the progress of oxidation of a conductive pattern and the formation of a thick oxide film can be prevented. Moreover, by being thin, the antioxidant layer can be easily removed in the latter steps, so as to enable reducing contact resistance between the conductive pattern and the conductive film.

In contrast, Chen discloses removing the photoresist layer 208 by using a plasma mixture of  $N_2H_2$  ( $H_2$ : 4%)/ $O_2$  at a low temperature whereby the copper oxide formed using a plasma mixture of  $N_2H_2$  ( $H_2$ : 4%)/ $O_2$  is loose copper oxide (*see* paragraph [0026]). Chen also discloses that a loose cupric oxide is  $Cu_2O$  (*see* paragraph [0011]). Therefore, under the conditions and process parameters disclosed in Chen, it is assumed that loose cupric oxide ( $Cu_2O$ ) mainly forms the resulting layer on surface 202a of Chen.

As described in Applicant's specification, Cu<sub>2</sub>O is not passive and thus does not adequately serve as an antioxidant layer for preventing the progress of oxidation at the surface of the copper line. Hence, Chen fails to disclose the step of forming a passive antioxidant layer, which contains oxygen rich CuO as a main component, on part of the surface of the conductive pattern such as the copper line while removing the resist pattern. On the other hand, in the present invention, a thin and passive antioxidant layer such as CuO is formed on the surface of the conductive pattern by performing oxygen plasma treatment, which is simpler than Chen's disclosed plasma treatment using a mixture of N<sub>2</sub>H<sub>2</sub> (H<sub>2</sub>: 4%)/O<sub>2</sub>.

As anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed, either expressly or inherently (noting that "inherency may not be established by probabilities or possibilities", *Scaltech Inc. v. Retec/Tetra*, 178 F.3d 1378 (Fed. Cir. 1999)), in a single prior art reference, *Akzo N.V. v. U.S. Int'l Trade Commission*, 808 F.2d 1471 (Fed. Cir. 1986), based on the forgoing, it is submitted that Chen does not anticipate claim 1, nor any claim dependent thereon.

## **B. Claim 5**

Claim 5 recites in pertinent part, "after forming the antioxidant layer, removing the resist pattern by performing oxygen plasma treatment." One of the features of the present invention as recited in claim 5 resides in after forming a passive antioxidant layer on part of the surface of the conductive pattern exposed by performing oxygen plasma treatment, removing the resist pattern by performing oxygen plasma treatment. According to the present invention, the progress of oxidation of a conductive pattern and the formation of a thick oxide film can be prevented. Moreover, by containing oxygen rich CuO as a main component and being thin, the antioxidant

layer can be easily removed in the latter steps, so as to reduce contact resistance between the conductive pattern and the conductive film. Furthermore, when removing the resist pattern under the conventional condition of a high temperature and high pressure, such as about 250°C and about 100 Pa, at which Cu<sub>2</sub>O occurs on the conductive pattern (Cu), oxidation does not progress. As a result, the resist pattern can be removed at high throughput.

Similarly to the discussion above with respect to claim 1, Chen fails to disclose forming a passive antioxidant layer on the surface of the conductive pattern such as a copper line. In addition, Chen also fails to disclose that after the formation of an antioxidant layer, removing the resist pattern by performing oxygen plasma treatment.

Moreover, according to the present invention as recited in claim 5, the passive antioxidant layer is formed on part of the surface of the exposed conductive pattern before removing the resist pattern by performing oxygen plasma treatment. Thus, the resist pattern can be removed under a condition of a high temperature, high pressure and high throughput without a growth of Cu<sub>2</sub>O on the surface of the conductive pattern. On the other hand, Chen discloses the removal of the photoresist layer only under a condition of low temperature (see paragraph [0026]), and thus the photoresist layer cannot be removed at high throughput.

The Examiner is directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard:

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

In the instant case, the pending rejection does not "establish *prima facie* obviousness of [the] claimed invention" as recited in claim 5 because the proposed combination fails the "all the claim limitations" standard required under § 103.

**C. Dependent claims**


Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claims 1 and 5 are patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

Based on all the foregoing, it is submitted that claims 1-10 are patentable over Chen. Accordingly, it is respectfully requested that the rejections under 35 U.S.C. § 102 and 103 be withdrawn.

**CONCLUSION**

Having fully and completely responded to the Office Action, Applicants submit that all of the claims are now in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below. To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,  
MCDERMOTT, WILL & EMERY

  
Ramyar M. Farid  
Registration No. 46,692

600 13<sup>th</sup> Street, N.W.  
Washington, DC 20005-3096  
(202) 756-8000 RMF:MWE  
Facsimile: (202) 756-8087  
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